

applying the cleaning composition to the polishing pad surface” and assumes that “substrates” refers to surface coatings other than the wafer itself.

Applicants have amended claim 5 to include “the water”, and have also amended claim 10 to replace “substrates” with “surface coating materials”. Applicants respectfully submit that amended claims 5 and 10 do not contain indefinite terms and are supported by the specification. Accordingly, applicants respectfully request allowance of claims 5 and 10. It should be noted that the claim amendments merely restate elements already present in the claims, make explicit what was inherent, and/or broaden the claims (e.g. deletion of “deionized” broadens the term “water”). Since no narrowing amendments are made, Applicants assert it is entitled to the full scope of equivalents.

Claims 4, 5 and 15 stand objected to under 37 CFR 1.75(c), as being improper dependent form for failing to further limit the subject matter of a previous claim.

Applicants have amended claims 4, 5, and 15. Applicants respectfully traverse this objection on grounds that amended claims 4, 5, and 15 are proper dependent form. Accordingly, applicants respectfully request allowance of claims 4, 5 and 15.

Claims 1-4, 8, and 12-16 stand rejected under 35 U.S.C. 102(b) as being anticipated by US Patent 5,981,454 to *Small et al.* The Examiner states that *Small et al.* discloses a cleaning composition comprising a composition that has an amine concentration that includes at least one endpoint of the claimed range, specifically 3.0 Wt% of at least one organic compound containing one or more amine or amide groups, such as the disclosed range of 3-20% in column 3, line 52 *et seq.*, and in Figure 3 for a range of activity below 3% (see e.g. column 4, line 6 *et seq.* and also see figure 3). The Examiner also states that *Small et al.* further discloses an acid or base such that the composition has a pH of between 3.5 and 7 in column 2, line 37 *et seq.* and column 3, line 52 *et seq.*

Applicants respectfully traverse this rejection on ground that *Small et al.* discloses a post clean treatment composition for removing chemical residues from metal or dielectric surfaces of a wafer or for chemical mechanical polishing of a copper surface from a wafer. *Small et al.* also discloses a method of cleaning a wafer including contacting the metal or dielectric surface with the post clean treatment composition to remove the chemical residues. *Small et al.* further discloses a method of chemical

mechanical polishing of a wafer including applying the post clean treatment composition to the copper surface, and polishing the surface in the presence of the post clean treatment composition.

Applicants respectfully point out that Figure 3 of *Small et al.* illustrates the corrosion rate of aluminum metal on a wafer versus the amount of amines dissolved in a water rinse system to show that small quantities of amines will be very corrosive to the metal on the wafer, such as about 3-20% or less of amines in water, as disclosed in column 3, lines 58-62 and in column 4, lines 7-10. Therefore, *Small et al.* teaches away the use of about 3-20% or less of amines in their post clean treatment composition because it can cause corrosion of metal structures on a wafer. In fact, the post clean treatment composition of *Small et al.* is modified to a specific pH range to only neutralize such amine impurities without destroying the metal oxide coatings on the wafer (see, column 4, lines 26-30).

Thus, *Small et al.* does not teach, show, or suggest a method of cleaning a polishing pad surface nor a composition for cleaning a polishing pad. Further, *Small et al.* does not teach, show, or suggest a method of cleaning a polishing pad surface including applying to the polishing pad surface a cleaning composition as recited in claims 1-4, 8, and 12-16. Accordingly, applicants respectfully request allowance of claims 1-8 and 11-14.

Claims 5-7, 9-11, and 17-18 stand rejected under 35 U.S.C. 103(a) as being obvious over *Small et al.* in view of US Patent 6,280,299 to *Kennedy et al.* The Examiner states that *Small et al.* apparently fails to explicitly disclose applying the solution to a rotating polishing pad at a flow rate of about 100 to 600 ml/min and *Kennedy et al.* discloses using a flow rate between 230 and 6000 ml/min in column 6, line 58 *et seq.*, and duration of the flow as about 5 to 20 seconds in column 7, line 47 *et seq.* Applicants respectfully traverse this rejection.

The teachings of *Small et al.* have been discussed above. *Small et al.* does not teach, show, or suggest a method of cleaning a polishing pad surface including applying to the polishing pad surface a cleaning composition and applying the composition to a rotating polishing pad at a flow rate of about 100 ml/min to about 600 ml/min, as recited in claims 6-7 and 17-18. Further, *Small et al.* does not teach, show, or suggest a

method of cleaning a polishing pad surface including applying to the polishing pad surface a cleaning composition and rinsing the polishing pad surface with water to remove any cleaning solution from the polishing pad surface, after applying the solution and prior to conducting CMP of a subsequent wafer, as recited in claims 8-9. Still further, *Small et al.* does not teach, show, or suggest a method of cleaning a polishing pad surface including applying to the polishing pad surface a cleaning composition and removing any surface coating materials from the wafer surface before applying the cleaning composition to the polishing pad surface, as recited in claim 10. Still further, *Small et al.* does not teach, show, or suggest a method of cleaning a polishing pad surface including applying to the polishing pad surface a cleaning composition and conditioning the polishing pad surface before, during and after applying the cleaning solution, as recited in claim 11. Therefore, the combination of *Small et al.* with any reference cannot serve as a basis for rejection.

*Kennedy et al.* discloses a method and apparatus for delivering one or more rinse agents, preferably one or more polishing fluids, to a polishing pad surface or a substrate surface. *Kennedy et al.* further discloses a method of cleaning one or more surfaces, such as a polishing pad surface and a substrate surface, by delivering a spray of one or more rinse agents to the surface and, preferably, causing the rinse agent to flow across the surface from a central region to an outer region where unwanted debris and material is collected.

*Kennedy et al.* does not teach, show, or suggest a cleaning composition including about 0.1 to about 3.0 wt.% of at least one organic compound containing one or more amine or amide groups, an acid or a base in an amount such that the composition has a pH of about 5.0 to about 12.0, and water, nor does *Kennedy et al.* teach, show, or suggest a method of cleaning a polishing pad surface by applying the cleaning composition as recited in claims 1 and 12.

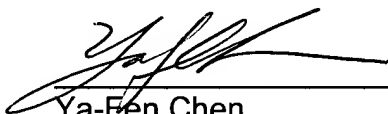
Therefore, the combination of *Kennedy, et al.* with *Small et al.* does not teach, show or suggest all claimed limitations as required for establishing prima facie obviousness. (MPEP 2143.03) Claims 5-7, 9-11, and 17-18 depend from claims 1 and 12, and are therefore patentable for the same reasons as claims 1 and 12. Accordingly, applicants respectfully request allowance of claims 5-7, 9-11, and 17-18.

Therefore, the references, neither alone nor in combination, teach, show, or suggest the claimed aspects of the invention as recited in claims 5-7, 9-11, and 17-18. Withdrawal of the rejection is respectfully requested.

In conclusion, the reference cited by the Examiner does not teach, show, or suggest the method of the claimed invention. Having addressed all issues set out in the Office Action, applicants respectfully submit that the claims are in condition for allowance and respectfully request allowance of the claims.

The prior art made of record is noted. However, it is believed that the secondary references are no more pertinent to the applicant's disclosure than the primary references cited in the office action. Therefore, it is believed that a detailed discussion of the secondary references is not deemed necessary for a full and complete response to this office action. Accordingly, allowance of the claims is respectfully requested.

Respectfully submitted,



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**Version With Markings To Show Changes Made**

Please amend claims 4-5, 10-12, 15 and 16.

Please cancel claims 19-25.

Please add new claims 26-32.

Please replace the following claims:

4. (Amended) The method according to claim 1, wherein the composition is a solution having a pH of about 5.0 to about [12.0]10.0.

5. (Amended) The method according to claim 2, wherein:

Cu and/or Cu-containing by-products are generated during CMP on the polishing pad surface;

the organic compound forms at least one complex with the Cu and/or Cu-containing by-products generated during CMP; and

the at least one complex is (are) dissolved in the [deionized] water.

10. (Amended) The method according to claim 1, further comprising removing any [substrates] surface coating materials from the wafer surface before applying the cleaning composition to the polishing pad surface.

11. (Amended) The method according to claim 1, comprising conditioning the polishing pad surface [at least one of] before, during and after applying the cleaning solution.

12. (Amended) A method comprising the sequential steps:

(a) conducting chemical-mechanical polishing (CMP) of [on] a first wafer [surface] containing copper (Cu) or a Cu-based alloy on a surface of a polishing pad;

(b) removing the first wafer from the polishing pad;

(c) applying to the polishing pad surface a cleaning composition comprising:

about 0.1 to about 3.0 wt.% of at least one organic compound containing one or more amine or amide groups;

an acid or a base in an amount such that the composition has a pH of about 5.0 to about 12.0; and

water;

(d) rinsing the polishing pad surface with water to remove any cleaning composition on the polishing pad surface;

(e) conducting CMP on a second wafer; and

(f) repeating steps (b) through (e).

15. (Amended) The method according to claim 12, wherein the composition is a solution having a pH of about 5.0 to about [12.0]10.0.

16. (Amended) The method according to claim 12, wherein;

Cu and/or Cu-containing by-products are generated during CMP on the surface of the polishing pad;

the at least one organic compound forms at least one complex with the Cu and/or Cu-containing by-products;

the at least one complex is (are) dissolved in the water; and

the cleaning composition containing the dissolved complexes are removed during rinsing.

19. (Canceled) [An apparatus for conducting chemical-mechanical polishing (CMP) on a wafer surface containing copper (Cu) or a Cu alloy, the apparatus comprising;

a platen;

a polishing pad or sheet mounted on the platen;

a first dispenser adapted to dispense a cleaning composition on a working surface on the polishing pad or sheet; and

a source of the cleaning composition coupled to the first dispenser, the cleaning composition comprising;

about 0.1 to about 3.0 wt.% of at least one organic compound containing one or more amine or amide groups;

an acid or a base in an amount in such that the cleaning composition has a pH of about 5.0 to about 12.0; and

the remainder water.]

20. (Canceled) [The apparatus according to claim 19, further comprising:  
a second dispenser adapted to a dispense water on a working surface of the polishing pad; and  
a source of water coupled to the second dispenser.]

21. (Cancelled) [The apparatus according to claim 20, wherein the second dispenser is adapted to dispense water under pressure.]

22. (Canceled) [The apparatus according to claim 20, further comprising a controller having a program for:

dispensing the cleaning composition on the polishing pad after conducting CMP on the wafer surface; and

dispensing the water from the second dispenser on the wafer surface, after applying the cleaning composition and before conducting CMP on another wafer.]

23. (Canceled) [The apparatus according to claim 21, further comprising a pad conditioner adapted to condition the polishing pad, wherein the controller is further programmed for conditioning the polishing pad with the pad conditioner at least one of before, during and after applying the cleaning composition.]

24. (Canceled) [The apparatus according to claim 19, wherein the composition is a solution having a pH or about 5.0 to about 12.0 and comprises:

ethylenediamine;

an acid selected from the group consisting of phosphoric acid, acetic acid and sulfuric acid, or a base selected from the group consisting of potassium hydroxide, sodium hydroxide and ammonium hydroxide; and  
the remainder water.]

25. (Canceled) [The apparatus according to claim 22, wherein the computer is programmed to:

apply the cleaning composition to a rotating polishing pad at a flow rate of about 100 to about 600 ml/min. for about 3 seconds to about 20 seconds after conducting CMP on each of a plurality of wafers; and

rinsing by applying pressurized water to the polishing pad surface for about 2 seconds to about 20 seconds.]

26. (Added) A method of cleaning, comprising:

conducting chemical-mechanical polishing (CMP) of a first wafer on a surface of a polishing pad;

removing the first wafer from the polishing pad; and

applying to the polishing pad surface a cleaning composition, wherein the cleaning composition further comprises:

about 0.1 to about 3.0 wt.% of at least one organic compound containing one or more amine or amide groups;

an acid or a base in an amount such that the composition has a pH of about 5.0 to about 12.0; and

water.

27. (Added) The method according to claim 26, wherein the cleaning composition is a solution comprising:

ethylenediamine;

an acid selected from the group consisting of phosphoric acid, acetic acid and sulfuric acid, or a base selected from the group consisting of potassium hydroxide, sodium hydroxide and ammonium hydroxide; and



the remainder water.

28. (Added) The method according to claim 26, wherein the cleaning composition is a solution having a pH of about 5.0 to about 10.0.
29. (Added) The method according to claim 26, wherein the cleaning composition is applied to a rotating polishing pad at a flow rate of about 100 ml/min to about 600 ml/min.
30. (Added) The method according to claim 26, wherein the cleaning composition is applied to a rotating polishing pad for about 3 seconds to about 20 seconds.
31. (Added) The method according to claim 26, further comprising rinsing the polishing pad surface with water to remove any cleaning composition on the polishing surface.
32. (Added) The method according to claim 26, further comprising conducting CMP of a second wafer after applying to the polishing pad surface the cleaning composition.